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ROUTING AND RECORD SHEET

INSTRUCTIONS: Officer designations should be used in the "TO" column. Under each comment a line should be drawn across sheet and each comment numbered to correspond with the number in the "TO" column. Each officer should initial (check mark insufficient) before further routing. This Routing and Record Sheet should be returned to Registry.

FROM:	TELEPHONE NO.
R&D Laboratory	DATE 20 May 1955

	TO	ROOM NO.	DATE REC'D	DATE FWD'D	OFFICER'S INITIALS	TELEPHONE	COMMENTS
1.	R & D	1800 Alcott		5/23			
2.	OC-E	1800 Alcott		5/24			
3.	PEB	1817 Alcott					
4.	OC-E-1			5/23			R.D Suggest Ops be advised we have recording which they could hear. Admin [redacted] 50X1 [redacted] 50X1 5/24/55
5.	~~OC-E-1~~						
6.							
7.	R&D			5/24			
8.	EP		20 May				
9.	BJA						9. One copy already filed.
10.	Marilyn						10. Please file original 050X1 return. Xerox copy to Lab.
11.							
12.	file in [redacted]						
13.							
14.							
15.							

FORM 1 MAY 54 51-10 PREVIOUS EDITIONS MAY BE USED

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[redacted] FIELD TESTS

50X1

REPORT

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[redacted] FIELD TESTS 50X1

1. Field Tests

Field tests of the RS-13 [redacted] Communications System were conducted during the week of April 18-22 on a crash priority basis. 50X1

2. Field Unit

The field unit incorporates the features of foreign equipment in use: specifically, automatic keying by means of a manually inked paper tape, transmitter, receiver, and power supply. The complete set is housed in an ordinary inconspicuous suitcase.

2.1. The tape is prepared by marking with conducting ink through a plastic stencil. As the tape is pulled through the keying head, four spring-loaded contacts scan the tape by contacting the conducting marks. Combinations of pairs of contacts conducting determine the transmission of marks and spaces. Keying is frequency shift with a 1000 cycle shift.

2.2. The rate of transmission is 300 wpm at an average output of 25 watts into a long wire antenna. Frequency range of the transmitter is 3 to 24 mc. The receiver is an RS-6A with a frequency range of 4.5 - 22 mc.

2.3. Primary power source for the field unit is 12 volts DC, usually a storage battery.

2.4. Initial contact with the base station is made by transmitting 110 cycle dots generated by driving the multivibrator with the output of the 110 cycle power supply vibrator.

3. Base Station

3.1. The receiving installation temporarily located at [redacted] for the tests was composed of two separate systems. One method employed magnetic tape recording for processing the received information while the other employed a Model RAPC undulator system for recording the information on paper tape by means of an ink recorder. 50X1

3.2. The magnetic tape method operates in the following manner: The signal is received on a receiver with the BFO set to give a 3000 cps beat on the mark signal. This results in a 2000 cps beat for the space. The audio output from the receiver's 600 ohm terminals is fed into the input of a mixer diode. An audio oscillator operating at 7000 cps with an output of approximately 1.0 volt is also fed into the input of the mixer tube. The resulting sum of these two frequencies, (7000 plus 3000 and 7000 plus 2000) is 10,000 cps for the mark and 9000 cps for the space. A 10,000 cps band pass filter is fed by the

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3.2. Continued

mixer output, resulting in approximately 8 db attenuation of the space signal. This output is fed into a magnetic tape recorder operating at a tape speed of 30 ips. Since the message speed is at the rate of 200 numerical groups per minute and since the mark frequency is 10,000 cps, a reduction of tape speed to 1/16th of the original results in a message speed of 12.5 groups per minute with a mark tone of 625 cps and a space tone of 562.5 cps. Thus the recorded message after reduction may be copied by an operator.

3.3. The RAPC method is conventional and employs the frequency shift converter-comparator group AN/URA-8A, which is made up of two CV-89/URA-8A frequency shift converters and one CM-22/URA-8A comparator, fed by two 51-J Collins receivers, employing diversity reception. The AN/URA-8 unit drives the RAPC recorder. Thus the message is directly recorded, in ink, by dots and dashes at the speed of transmission. The message may then be visually read from the tape.

3.4. An auxiliary transmit-receive circuit was maintained between the receiving site and field site. The field unit employed an RS-6 radio set for this purpose and a Collins 16-F transmitter was used at the base station.

4. Test Results

The systems operation was checked between the receiving site and the Laboratory, prior to the departure into the field. Reception with both systems was satisfactory after certain repairs and adjustments to the RS-13 equipment. Indications were that trouble could be expected with the RS-13 keying mechanism. The tape drive motor on one of the two units showed signs of binding with a resulting slow speed. However, one unit performed very satisfactorily.

4.1. Tests with the field party located in the vicinity of Lexington, Kentucky were conducted on 19 April 1955. Difficulties with the keying mechanism resulted in approximately 50% of the transmissions being unsatisfactory on both receiving systems. In view of this fact a second series of tests were conducted from the same location on 20 April 1955. The results of these tests were very satisfactory. 100% copy of the transmission was obtained on both systems. However, indications were that the keying mechanism was not operating completely satisfactorily, and transmissions were not 100% accurate with respect to the keying tape.

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4.2. A third test was conducted from Denver, Colorado on 21 April 1955. Receiving conditions were very poor, propagation unfavorable for the frequencies available, and strong interference from multiplex and other types of transmissions was present on all available channels. Every effort was put forth to maintain auxiliary and RS-13 contacts with very little success. Toward 1500 EST the signals began to improve and sporadic reception at the receiving site was possible. From 1530 to 1600 reception was fair but masked by heavy multiplex interference on 16.001 mc. Dot transmissions were recorded magnetically with periodic success but the test messages failed to break through. About 50% copy was obtained with the RAPC system. In general, the signal was too weak for satisfactory copy or recording.

5. Field Unit Performance

5.1. All of the difficulties encountered were directly associated with the keying mechanism. The reading heads as used in the field tests were the result of a quick redesign. The sensing contacts in the original heads were replaced by wire fingers to alleviate sticking and misalignment problems. The size wire, length of sensing arm and angle of contact needs further study but, in principle, this type head is considered an improvement over the original type.

5.2. The paper drive mechanism does not have constant speed characteristics. Variations in tape speed, caused by binding of the gear train and wide tolerances in the bearings points up the need for improvement in the mechanical design of the unit. It is suggested that the paper drive roller pressure adjustment be made relative to its framework and the sensing pressure adjustment.

5.3. It is further recommended that more consideration be given to the technique of tape marking with a view toward greater efficiency and accuracy of the system.

5.4. No difficulty was encountered with the transmitter power amplifier or keying circuit. However, the switch detent mechanism on both field units bound up and had to be lubricated.

6. Conclusion

6.1. In general, reception of the RS-13 transmissions was satisfactory considering only those transmissions made with the keying mechanism functioning properly. A programmed tape recording is available containing exerpts of the test employing the magnetic tape method. Samples of the tapes from the RAPC are attached to this report.

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6.2. The discrete frequencies available for the field tests were chosen at random within the range of the equipment and propagation requirements. Frequencies assigned were 4, 4.5, 7, 7.5, 12 and 16 mc. Due to the excessive amount of QRM, especially on 12 and 16 mc, the operation was greatly curtailed by not having alternate frequencies in the close proximity of 12 and 16 mc. More latitude in choice of frequencies would have enabled the operator to avoid some of the QRM on the frequencies assigned.

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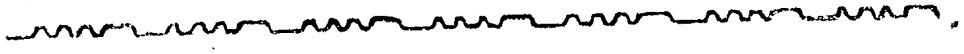
Good Copy - RS-13 Transmissions

With the RAPC Undulator



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